

## Knowledge and Factors Associated with Compliance of Standard Precautions in Clinical Exposure among Proficiency Certificate Level Nursing Students of Pokhara, Nepal

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### ABSTRACT

**Introduction:** The compliance with standard precautions during clinical exposure prevents the risk of infections in health professionals. Despite high degree effectiveness of standard precautions, low compliance rates has been reported among the nursing students in Nepal. This study aimed to assess the knowledge and factors associated with the compliance of standard precautions in clinical exposure among the nursing students in Pokhara, Nepal.

**Methods:** A cross-sectional study was conducted in between July to December 2019 among 208 Proficiency Certificate Level nursing students studying in different nursing schools in Pokhara. Self-reporting questionnaire was used as a tool to determine knowledge on standard precautions and Compliance with Standard Precautions Scale (CSPS) was used to measure compliance rate. Chi-square test was performed to assess the factors associated with the compliance of standard precautions and binary logistic regression was performed to measure the strength of association.

**Results:** Out of 208 students participated in the study; the overall compliance rate with standard precautions was 65%. Similarly, 91.3% nursing students had fair and only 2.9% had a good knowledge on standard precautions with average knowledge score 12.15 out of 24. Multivariable analysis revealed age <18 years (AOR=2.307, 95% CI: 1.217-4.371), availability of infection control (IC) guidelines in wards (AOR=5.331, 95% CI: 1.852-15.345) and feedback on safety practices (AOR=7.419, 95% CI: 1.409-39.061) as the predictors of compliance of standard precautions among nursing students.

**Conclusion:** The study concluded that, despite having fair knowledge on standard precautions, compliance rate is comparatively less among the students. Age of students, availability of infection control (IC) guidelines and feedback on safety practices were identified as significant predictors. There is an immediate need of training/orientation on standard precautions before clinical posting along with provision of infection control guideline in wards and supportive supervision and feedback during clinical exposure.

**Keywords:** *Compliance, Knowledge, Nursing students, Standard precautions*

### INTRODUCTION

In 1996, the United States Centres for Disease Control and Prevention (CDC) issued Standard Precautions, which refers to set of infection control guidelines that helps to minimize the risk of transmission of blood borne and other pathogens.<sup>1-3</sup> Health professionals especially nursing students are at an increased risk of acquiring infections during direct interaction with the patients.<sup>4</sup> Hospital Acquired Infections (HAIs) alone are estimated to account for 1.7 million infections among health care providers and patients within a year according to the data obtained from American Hospitals.<sup>5</sup> Both developed and developing countries face the problem of HAIs resulting in serious and life threatening health conditions degrading the quality of healthcare.<sup>6-8</sup> Thus, it is a very serious concern for the public health.

Nursing students are at higher risk as they are at their learning phase and lack experience. Numerous self-reported studies have reported low compliance rates among the nursing students.<sup>1,9-11</sup>

A study conducted among nursing students in Saudi Arabia reported a compliance rate of 61%.<sup>4</sup> Another study conducted in Bir Hospital, Kathmandu, Nepal showed that only 57.1% of the nurses had adequate knowledge and only 48.2% were found to have good practice of infection prevention.<sup>12</sup> Similarly, a study conducted in India, showed

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66% of nursing students had an average knowledge regarding universal precautions and only 20% showed satisfactory performance of universal precautions.<sup>13</sup> Moreover, study in Myanmar found that 91.18% had a good knowledge of standard precautions and only 73.5% of nurses had good adherence to standard precautions<sup>14</sup>.

The findings of previous studies have identified various factors associated with non-compliance of standard precautions, which includes age, academic study year, training on infection control, and knowledge on standard precautions, management support and accessibility of personal protective equipment.<sup>5, 15, 16</sup>

It is very important to ensure strict adherence to the standard precautions by all health care workers including nursing students to prevent the occurrence of HAI's and ensuring the safety of nursing staffs and patients in hospitals. However, in context of developing country like Nepal, only 57.1% nurses had adequate knowledge and 48.2% had good practice on infection prevention according to the study conducted in Kathmandu.<sup>12</sup> In addition, studies on this topic are limited among nursing students. Thus, this study aimed to assess the knowledge and factors associated with compliance of standard precautions among nursing students in Pokhara. The findings of this study could provide some insights on the factors that influence compliance rate that could be useful for more effective implementation of standard precautions.

## METHODS

A cross-sectional study was conducted among nursing students in Pokhara from July to December 2019. The study population was 478 proficiency certificate level (PCL) nursing students studying in second and third year in six nursing schools in Pokhara Metropolitan, Nepal. A sample size of 208 was calculated based on 61% compliance rate among nursing student in a study-conducted Saudi Arabia. Required number of participants from each nursing colleges of Pokhara was determined proportionately based on the number of students per nursing school, and simple random sampling was performed to select individual participant. Self-reporting questionnaire was the tool for data collection. Reliability and validity were maintained by pretesting and validation of the tools. Ethical approval was obtained from Institutional Review Committee (IRC), Pokhara University Research Centre (PURC) (81/ 076/077). Permission to use the Compliance with Standard Precautions Scale (CSPS) was obtained (A500B12-201908) from the copyright holder. Written

approval was taken from respective nursing colleges and informed consent was obtained from each respondent. Privacy and confidentiality of the obtained information was maintained as per national and international ethical guidelines.

Self-reporting questionnaire was used for data collection. A 24-item scale measured knowledge where each right response was provided a score of 1. The score within range of 17-24 recoded as "good knowledge", 9-16 as "fair knowledge" and 0-8 as "poor knowledge". Questionnaire was prepared by thorough literature review and included all the major components of standard precautions recommended by CDC, which mainly included knowledge on hand hygiene, use of PPE, sterilization of patient care equipment, safe injection practices, safe disposal of sharps and appropriate respiratory hygiene.<sup>7, 17</sup> The questionnaire was pre-tested for ensuring validity.

Likewise, compliance was determined by using compliance with standard precautions scale (CSPS) (Cronbach's alpha=0.73) which consists of 20 items, each item was provided with a 4 point which consists of 0=never, 1=seldom, 2=sometimes and 3=always. Items 2, 4, 6 and 15 were reversed as they were negatively worded. Only "always" was scored as 1, while other were considered as 0. Score ranging from 0-20 where score below average score was recorded as "low" and score equal to or above average score was recorded as "high" compliance.

The total compliance rate refers to the average compliance rate of all 20 items in percentage. Compliance rate >90% considered as optimal compliance, 80%-89% as satisfactory compliance, 50%-79% as suboptimal compliance and < 49% as poor compliance.

Data entry was carried in Epi-Data 3.1 and the data analysis was carried out using statistical package for social science (SPSS) version 20. Baseline variables were expressed in terms of descriptive statistics such as frequencies, proportions, mean and standard deviation. Bivariate analysis was performed by Pearson's chi-square (Fisher's Exact test where chi-square is not applicable) test to find out association between dependent and independent variables. Factors those are significant at the level of  $p < 0.05$  were brought for binary logistic regression analysis. Both adjusted and unadjusted odd ratio were used to measure the strength of association between dependent and independent variables. Variables those are significant after adjustment of covariates were used to draw the inference.

## RESULTS

### Socio-demographic Characteristics

The socio-demographic characteristics of study population is presented in table 1. It showed that out of 208 respondents, four-fifth of the respondents (80.3%) were in the age group of 17-19 years with mean age of 17.88(S.D.±3). Majority of the participants were unmarried (98.1%) and most of them belonged to relatively advantaged Janajati ethnic group (37%). More than half of the respondents were completely immunized against hepatitis B (55.8%) and had worked in hospitals for duration of more than or equal to 5 months (57.7%). Almost two-third of the participants (68.8%) achieved an average grade within 3.0-3.5 with mean grade point average (GPA) of 3.21(±1). Just below half of the students had received training on standard precautions (46.2%) and had experienced needle stick injury (NSI) (48.6%).

Table 1: Socio-demographic characteristics

Variables	Frequency (n=208)	Percent (%)
Age		
≤16 years	23	11.1
17-19 years	167	80.3
≥20 years	18	8.7
Marital Status		
Married	4	1.9
Unmarried	204	98.1
Ethnicity		
Relatively Advantaged Janajati	77	37.0
Upper Caste Group	69	33.2
Disadvantaged Janajati	44	21.2
Dalit	18	8.7
GPA of SEE		
<3 GPA	43	20.7
3.0-3.5 GPA	143	68.8
>3.5 GPA	22	10.6
Received training on standard precautions		
Yes	96	46.2
No	112	53.8
Immunized with HBV		
Complete (3 dose)	116	55.8

Incomplete (<3 dose)	44	21.2
No immunization	48	23.1
Experienced needle stick injury		
Yes	101	48.6
No	107	51.4
Duration of clinical exposure		
<5 months	88	42.3
≥5 months	120	57.7

GPA: Grade Point Average, SEE: Secondary Education Examination, HBV: Hepatitis B Virus

### Knowledge level on standard precautions

The knowledge level of the respondents on standard precautions is shown in table 2. Vast majority of the respondents (91.3%) scored within the range of 9 to 16, which was interpreted as "Fair knowledge". A very few respondents (5.8%) scored within the range of 0 to 8, which was interpreted as "Poor knowledge" and only 2.9% scored within the range of 17-24, which was interpreted as "Good knowledge". In general, the nursing students possess "Fair Knowledge" on standard precautions with a mean score of 12.15.

Table 2: Knowledge level on standard precautions

Score Range	Frequency (n=208)	Percentage (%)
0-8	12	5.8
9-16	190	91.3
17-24	6	2.9
Average Score	12.15	

### Compliance rate on standard precautions

The overall compliance rate of standard precautions among the study participants is presented in Table 3. It showed that overall compliance rate among the nursing students was 65.0%. The highest compliance on disposal of sharp articles into sharp boxes (96.2%), followed by wearing of gloves when exposed to body fluids, blood product, and any excretion of patients (94.2%), Covering of mouth and nose when wearing a mask (93.3%) and decontamination of hands immediately after removal of gloves (92.8%). Whereas, the lowest level of compliance on the disposal of sharp box only when it is full (9.1%), followed by recapping used needles after giving an injection (12.0%) and use of alcoholic hand rubs as an alternative when hands are not

visibly soiled (25.0%). Thus, compliance rate on standard precautions was found to be “Suboptimal” among the study participants.

Table 3: Compliance rate on standard precautions among nursing students (n=208)

S.N	Item	Compliance Rate (%)
1.	I wash my hands between patient contacts.	80.8
2.	I only use water for hand washing. <sup>a</sup>	42.3
3.	I use alcoholic hand rubs as an alternative if my hands are not visibly soiled.	25.0
4.	I recap used needles after giving an injection. <sup>a</sup>	12.0
5.	I put sharp articles into sharp boxes.	96.2
6.	The sharps box is disposed only when it is full. <sup>a</sup>	9.1
7.	I remove Personal Protective Equipment (PPE) in a designated area.	81.7
8.	I take a shower in case of extensive splashing even after I have put on PPE.	51.9
9.	I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts.	82.7
10.	I wear gloves when I am exposed to body fluids, blood product, and any excretion of patients.	94.2
11.	I change gloves between patient contacts.	69.2
12.	I decontaminate my hands immediately after removal of gloves.	92.8
13.	I wear a surgical mask alone or in combination with goggles, face shield and apron whenever there is a possibility of a splash or splatter.	44.2
14.	My mouth and nose are covered when I wear a mask.	93.3
15.	I reuse a surgical mask or disposable PPE. <sup>a</sup>	64.4
16.	I wear a gown or apron when exposed to blood, body fluids or any patient excretions.	69.7

17.	Waste contaminated with blood, body fluids, secretion and excretion is placed in red plastic bags irrespective of the patient's infection status.	61.5
18.	I decontaminate surfaces and equipment after use.	76.4
19.	I wear gloves to decontaminate used equipment with visible soils.	81.7
20.	I clean up spillage of blood or other body fluids immediately with disinfectants.	77.4
Overall Compliance Rate		65.0

Note: <sup>a</sup> Reverse scored items

The compliance score of study participants on standard precautions was 13.06. Based on this score, compliance on standard precaution was found high (if  $\geq 13.06$ ) among 63.5% (132) participants and low (if  $< 13.06$ ) among 36.5% (76) participants.

#### Association of variables with compliance of standard precautions

**Bivariate Analysis:** In chi square test, out of eighteen selected variables, only five of them were found to significantly associated with compliance of standard precautions. ( $p < 0.05$ ). Age below 18 years of age, training on standard precautions, immunization with HBV, availability of infection control guidelines and feedback on safety practices were significantly associated with compliance of standard precautions (Table 4).

Table 4: Association between different variables and compliance of standard precautions (n=208)

Variables	Compliance		$\chi^2$ value	p-value
	High 132 (63.5%)	Low 76 (36.5%)		
Age				
<18 years	67 (71.3)	27 (28.7)	4.517	0.034*
$\geq 18$ years	65 (57.0)	49 (43.0)		
Marital status				
Married	3 (75.0)	1 (25)	Fisher's Exact=1.000	0.535
Unmarried	129 (63.2)	75 (36.8)		
Ethnicity				
Dalit	12 (66.7)	6 (33.3)	0.087	0.768
Non-Dalit	120 (63.2)	70 (36.8)		
Religion				

Hindu	109 (66.9)	54 (33.1)	3.777	0.052	Private	95 (61.3)	60 (38.7)	1.237	0.266
Non-Hindu	23 (51.1)	22 (48.9)			Public	37 (69.8)	16 (30.2)		
GPA of SEE					Availability of infection control guidelines				
≥3.2 GPA	91 (64.1)	51 (35.9)	0.075	0.784	Yes	126 (67.4)	61 (32.6)	12.263	<0.001*
<3.2 GPA	41 (62.1)	25 (37.9)			No	6 (28.6)	15 (71.4)		
Year studied					Adequate supply of water				
Third	60 (58.8)	42 (41.2)	1.857	0.173	Yes	118 (62.4)	71 (37.6)	0.942	0.332
Second	72 (67.9)	34 (32.1)			No	14 (73.7)	5 (26.3)		
Received training on standard precautions					Received feedback from supervisor				
Yes	70 (72.9)	26 (27.1)	6.874	0.009*	Yes	130 (65.3)	69 (34.7)	Fisher's Exact=0.013	0.013*
No	62 (55.4)	50 (44.6)			No	2 (22.2)	7 (77.8)		
Experienced needle stick injury					Availability of sharp disposal boxes				
Yes	65 (64.4)	36 (35.6)	0.068	0.795	Yes	130 (63.1)	76 (36.9)	Fisher's Exact=0.534	0.402
No	67 (62.6)	40 (37.4)			No	2 (100)	0 (0)		
Experienced HAI					<i>*Statistically significant at p&lt;0.05</i>				
Yes	14 (70.0)	6 (30.0)	0.408	0.523	GPA: Grade Point Average, SEE: Secondary Education Examination, HAI: Hospital Acquired Infections, HBV: Hepatitis B Virus				
No	118 (62.8)	70 (37.2)							
Immunized with HBV					Multivariate Analysis: Factor associated with compliance of standard precaution is presented in the Table 5. In multivariable logistic regression analysis only three factors age <18 years (AOR 2.307, 95% CI: 1.217-4.371), availability of infection control guideline in wards (AOR 5.331, 95% CI: 1.852-15.345) and received feedback from supervisor (AOR 7.419, 95% CI: 1.409-39.061) were revealed as the factor associated with compliance of standard precautions among nursing students. However, training on standard precaution and immunization against hepatitis B were found significant in bivariate analysis but non-significant in multivariable analysis.				
Immunization	108 (67.5)	52 (32.5)	4.877	0.027*					
No Immunization	24 (50.0)	24 (50.0)							
Financing for study									
Parents/Self	117 (62.2)	71 (37.8)	1.270	0.260					
CTEVT/GoN scholarship	15 (75.0)	5 (25.0)							
Duration of clinical exposure									
≥5 months	74 (61.7)	46 (38.3)	0.394	0.530					
<5 months	58 (65.9)	30 (34.1)							
Type of last posted hospital									

Table 5: Factors associated with compliance of standard precautions (n=208)

Variable	UOR	95% CI	AOR	95% CI	p-value
Age					
<18 years	1.871	1.047-3.343	2.307	1.217-4.371	0.010*
≥18 years	1		1		
Received training on standard precaution					
Yes	2.171	1.210-3.895	1.714	0.912-3.223	0.094
No	1		1		
Immunized against Hepatitis B					
Immunization	2.077	1.078-4.000	2.016	0.998-4.112	0.054
No Immunization	1		1		
Availability of infection control guideline					
Yes	5.164	1.909-13.965	5.331	1.852-15.345	0.002*
No	1		1		

Received feedback from supervisor

Yes	6.594	1.334-32.608	7.419	1.409-39.061	0.018*
No	1		1		

\*Statistically significant at  $p < 0.05$

## DISCUSSION

This study found that only 2.9% nursing students had a “good knowledge” on standard precautions whereas, a vast majority of the respondents (91.3%) had a “fair knowledge” and 5.8% had “poor knowledge” on standard precautions. In general, the nursing students showed a fair knowledge on standard precautions with a mean score of 12.15 out of 24. The results of a study conducted in Jordan and India also reported inadequate knowledge on infection control precautions among nursing students.<sup>6,13</sup> Likewise, a study in Kuwait also yielded the poor knowledge among university medical students.<sup>1</sup> It indicates that nursing students require additional orientation and training on standard precautions along with effective classroom teaching learning activities.

The findings of this study also indicated that the overall compliance rate with standard precautions was 65% among nursing students. This finding is consistent with the results of three studies conducted in Saudi Arabia where the compliance rates were 61.0%, 60.1% and 56.8%.<sup>4,15,18</sup> Similarly, study among Jordanian nursing students found out moderate compliance.<sup>6</sup> However, study in Nepal showed that 48.2% had a good practice of standard precautions.<sup>12</sup> Adhering to the guidelines of standard precautions is a primary strategy for preventing the risks of infections especially in context of developing country like Nepal.

The result of this study showed that nursing students of below 18 years were about two times (AOR 2.307, 95% CI: 1.217-4.371) more likely to comply with the standard precautions as compared to those of 18 years and above. Another study conducted in Nepal in 2011 also reported higher compliance to infection control practices among younger nurses than others.<sup>19</sup> Similarly, study conducted in Jordan<sup>20</sup> and Iran<sup>21</sup> showed an association between age and compliance of standard precautions. This could be related to the fact that the younger students have less experience of working in clinical setting. Thus, they might tend to follow safety precautions due to the fear of being infected.

In addition, the result of this study showed that the chance of compliance with standard precaution is about five

times higher (AOR 5.331, 95% CI: 1.852-15.345) among nursing students where there is availability of infection control guideline in each wards as compared to those students who did not had infection control guidelines. Studies from Ethiopia and Jordan also reported the significant association between availability of infection control guideline in ward and compliance with standard precautions.<sup>22,23</sup> This finding implies that the presence of infection control guidelines in each wards/departments of the hospital may guide the nursing students to follow and implement the safety precautions more frequently and effectively.

Likewise, those students who received feedback from their supervisors during their clinical exposure were about seven and half times (AOR 7.419, 95% CI: 1.409-39.061) more likely to follow standard precautions compared to those who did not received any feedback. This finding demonstrates that feedback on safety practices can influence the compliance level of nursing students and enhance utilization of standard precautions more frequently. This result is consistent with the findings of in Iowa<sup>24</sup> and Canada<sup>25</sup> which showed that the nurses perceiving good feedback had higher compliance rates.

## CONCLUSION

The study concluded that, despite having fair knowledge on standard precautions, compliance rate is comparatively less among the students. Age of students, availability of infection control (IC) guidelines and feedback on safety practices were identified as significant predictors of compliance with standard precautions. There is an immediate need to emphasize on standard precautions while conducting teaching learning activities for nursing students along with training/orientation before clinical posting to increase the knowledge and compliance regarding standard precautions. Moreover, provision of infection control guideline in health departments/wards and supportive supervision and feedback during clinical exposure are crucial for nursing students for better compliance with standard precautions.

## CONFLICT OF INTEREST

We declare no conflict of interest.

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